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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/540,524	03/31/2000	Jose Tamez-Pena	000687.00138	1816

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EXAMINER	
FETZNER, TIFFANY A	
ART UNIT	PAPER NUMBER
2859	

DATE MAILED: 05/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/540,524	TAMEZ-PENA ET AL.	
	Examiner	Art Unit	
	Tiffany A Fetzner	2859	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 July 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-10,12,13,28,29,31-37,39 and 40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-10,12,13,28,29,31-37,39 and 40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 March 2000* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 2.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. 05/11/2004
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED First action after RCE

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on July 25th 2002 has been entered.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

Drawings

3. This application has been filed with informal drawings which are acceptable for examination purposes only. The Official draftsperson has objected to applicant's submitted drawings See the attached PTO 948 Official Draftsperson's Review Form, of May 11th 2004 which accompanies this office action Formal drawings which correct the objections noted on the PTO 948 form are required in response to this office action.

Election with traverse

4. The election of **claims 1, 2, 4-13, 28, 29**, and **31-40** with traverse from the March 13th 2002 response has been noted.

Canceled Claims

5. The cancellation of **claims 11** and **38** without prejudice from the July 25th 2002 amendment and response has been noted. The pending elected claims are **claims 1, 2, 4-10, 12-13, 28, 29, 31-37,** and **39-40**.

Withdrawn Claims

6. **Claims 3, 14-27, 30,** and **41-54** are withdrawn from consideration by the examiner as claims being drawn to a non-elected invention.

Response to Arguments

7. Applicant's arguments from the Amendment Response filed 07/25/2002 with respect to pending **claims 1, 2, 4-10, 12-13, 28, 29, 31-37,** and **39-40**, have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

8. **Claims 1, 2, 4-10, 12-13, 28, 29, 31-37,** and **39-40** rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are:

A) the fact that applicant's amended independent claims 1 and 28 specify formation of an isotropic, high resolution, three-dimensional image of a subject, but applicant only performs a scan in two—dimensions. A third scan is never performed within the context of the claim. The step of How the three-dimensional image is formed from only two scans is missing. The steps and system of claims 1 and 28 do not enable

a three-dimensional image. Therefore the step and corresponding system feature that forms an image is missing and indicates that at least one essential method step, feature, and or element is lacked by applicant's independent claims.

B) **Claims 6-9** and **33-36** specify correlating the data through hill climbing, but fails to specify the elements or steps of the independent claims on which, or from which, the hill climbing technique is based, (i.e. from what to what, or from where to where) and in which step of the independent claim it occurs, which directly suggests that at least one essential method step, feature, relationship and / or element, is lacked by **claims 6-9** and **33-36.** (The examiner notes that the slice values of **Higashi** start from 1-256, and the phase encoded values also proceed from 1-256, which broadly suggests a hill-climbing via a linearly increasing progression of the image data in each scanned direction, however the missing steps, or elements, or features, of claims, 6-9 and 33-36 prevents the examiner from determining the merits of these claims with respect to the **Higashi** article.)

9. In view of the rejection of **claims 6-9** and **33-36**under 35 USC § 112, no art has been developed for these claims because improper speculation as to the scope and meaning of the claims would be required by the examiner. See In re Steele 134 USPQ 292.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. **Claims 1, 2, 4, 5, 10, 12, 13, 28, 29, 31, 32, 37, 39,** and **40** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Higashi** M article "FASE (fast advanced spin echo) Nippon rinsho. Japanese journal of clinical medicine (JAPAN) Nov 1998, 56 (11) p2783-91, ISSN 0047-1852. Applicant note that the rejections made are valid as best as the examiner can determine without a formal English translation. Should applicant with to argue the rejections below applicant must supply a full English translation of this article to the examiner with the next response, so that any argued position can be properly assessed by the examiner.

13. With respect to **Amended Claim 1,** and **corresponding system claim 28, Higashi** teaches and shows, "A method of forming an isotropic, high resolution, three-dimensional, image of a subject, [See abstract] "the method comprising: (a) scanning the subject in a first direction" [See page 2786 where any of the "A", "B" "C" lines shown for MRP meet this limitation.] "to take image data of a first plurality of slices" The examiner notes that in multi-shot EPI a plurality of slices is obtained, one slice per shot, and each of the "A", "B" "C" lines shown for MRP meet this limitation, is executable with

multi-shot EPI. [See page 2784 which shows multi-shot EPI being performed; and page 2786 the examiner considers each directional scan of the "A", "B" "C" lines to each be representative of a multi-shot EPI sequence.]

14. **Higashi** teaches and shows, applicant's step "(b) scanning the subject in a second direction which is different from the first direction to take image data of a second plurality of slices; [See pages 2786 and 2784 where the directions of the EPI multi-shot sequences "A", "B" "C" are each shown to be in different directions] **Higashi** also teaches and shows, step "(c) registering the first plurality of slices with the second plurality of slices; to define a matrix of isotropic, high resolution voxels having unknown high resolution values [See the abstract where the post processing after the acquisition with MIP and / or MPR produces high resolution isotropic voxel viewing from any angle. See also the 3d FASE section which starts on page 2785-2788. The ability to view cross sections from any angle is also referred to on page 2789.]

15. **Higashi** lacks directly teaching the step of solving for the unknown high-resolution voxel values in the matrix defined in step (c) in accordance with the image data taken in steps (a) and (b) to form the image." However, because the resolution of **Higashi** depends on the post processing of the MPI and MPR techniques, uses the image data from the different directions, of each multi-shot sequence, and obtains high-resolution isotropic voxels, with each voxel having the same length in each of the three directions, It would have been obvious to one of ordinary skill in the art at the time that the invention was made that the resolution of **Higashi** is determined by the process in which the different directional data for the plurality of slices is combined. Therefore, step

(d) is considered to be a readily obvious, and necessary aspect of the **Higashi** Japanese article even though it is not explicitly stated.

14. With respect to **Claim 2**, and corresponding system **claim 29**, **Higashi** suggests that the second direction (i.e. C on page 2786) is orthogonal to the first direction (i.e. A on page 2786) because the paths appear to be orthogonal to each other Additionally because **Higashi** teaches viewing from any desired direction in the abstract, the ability to have the directions be orthogonal to one another is directly met by the **Higashi** Japanese article. The same reasons for rejection, that apply to **Amended claims 1, 28** also apply to **claims 2, 29**.

15. With respect to **Claim 4**, and **corresponding system claim 31**, **Higashi** suggests that "step (c) comprises maximizing a correlation based on the image data of the first and second pluralities of slices" because isotropic image voxels are produced by **Higashi** [See abstract, pages 2785 through 2789] and isotropic voxels necessarily have a maximized correlation because the dimensionality of every voxel is the same in each of the three dimensions, (i.e. the resolution per voxel is equivalent in any viewing direction). The same reasons for rejection, that apply to **Amended claims 1, 28** also apply to **claims 4, 31**.

16. With respect to **Claim 5**, and **corresponding system claim 32**, **Higashi** suggests that the correlation is a correlation of gradients of the image data of the first and second pluralities of slices" because **Higashi** corrects the phase of each single-shot or multi-shot EPI sequence. [See pages 2784 through 2789 The same reasons for rejection, that apply to **Amended claims 1, 28** also apply to **claims 5, 32**.

21. With respect to **Claim 10**, and **corresponding system claim 37**, **Higashi**, teaches and suggests the correlation is a correlation of a subsample of the image data of the first plurality of slices with a subsample of the image data of the second plurality of slices" [See abstract, the discussion on the formation of the isotropic 3d voxels pages 2785-2789 and the figure showing directions A, B, and C on page 2786]. The same reasons for rejection, that apply to **Amended claims 1, 4, 5, 28, 31, 32** also apply to **claims 10, 37**.

25. With respect to **Amended Claim 12**, and **corresponding amended system claim 39, Higashi**, suggests that step (d) comprises treating the image as a linear combination of at least two low resolution functions (i.e. **Higashi**, teaches and shows at least two back projected value lines for MIP and / or MPR [See page 2786, 2783, 2788 and the abstract]) and deriving the functions from the image data of the first and second pluralities of slices. [See the teachings regarding image reconstruction, with the acquired data taught throughout the entire reference. [See pages 2783 through 2790] The same reasons for rejection, that apply to **Amended claims 1, 28,** also apply to **amended claims 12, 39**.

26. With respect to **Claim 13,** and **corresponding system claim 40**, **Higashi**, teaches that the functions are derived through an iterative process using the image data of the first and second pluralities of slices as initial assumptions for the functions, because the corrections that are made to the data use the initial directional slices as a referential initial assumption. [See pages 2783 through 2790] The same reasons for rejection, that apply to **Amended claims 1, 28,** also apply to **amended claims 13, 40**.

Prior Art of Record

30. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

A) **Stark et al.,** US patent 5,568,400 issued October 22nd 1996

B) **Freundlich et al.,** US patent 6,178,220 B1 issued January 23rd 2001; with a 102 (e) date of October 18th 1999.

C) **Catherine Westbrook** and **Carolyn Kaut** textbook "MRI in Practice SECOND EDITION" Blackwell Science, Inc., pages 47-57 and pages 101-103 1998.

D) **Bushberg et al.,** textbook "The Essential Physics of Medical Imaging" Williams and Wilkins Philadelphia pages 325-327; 332-333; 336-339 1994.

E) **Freundlich et al.,** PCT publication WO 98/24063 published 4 June 1998.

F) **Mellin**, A.F. et al, "Three dimensional magnetic resonance microangiography of rat neurovasculature" magnetic resonance in medicine vol. 32, no.2 pages 199-205 1994. this reference teaches isotropic voxels of 59 μm resolution obtained from a FOV with dimensional directions of 15 x 30 x 30 mm., and a matrix size of 256 x 256 x 512. [See page 200 col. 1 paragraph 2, therefore using different resolutions to achieve isotropic voxels was known by **Mellin**, in 1994]

G) **Henson** M M; et al., "Imaging the cochlea by magnetic resonance microscopy" Hearing research (NETHERLANDS) May 1994, 75 (1-2) pages 75-80, ISSN 0378-5955

H) **Maier et al.,** US patent 5,786,692 issued July 28th 1998.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-

2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

17. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306**.

Tiffany A. Fegan

TAF
May 15, 2004

Diego Gutierrez
Supervisory Patent Examiner
Technology Center 2800

Attachment for PTO-948 (Rev. 03/01, or earlier)
6/18/01

The below text replaces the pre-printed text under the heading, "Information on How to Effect Drawing Changes," on the back of the PTO-948 (Rev. 03/01, or earlier) form.

INFORMATION ON HOW TO EFFECT DRAWING CHANGES

1. Correction of Informalities -- 37 CFR 1.85

New corrected drawings must be filed with the changes incorporated therein. Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and centered within the top margin. If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings **MUST** be filed within the **THREE MONTH** shortened statutory period set for reply in the Notice of Allowability. Extensions of time may NOT be obtained under the provisions of 37 CFR 1.136(a) or (b) for filing the corrected drawings after the mailing of a Notice of Allowability. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

2. Corrections other than Informalities Noted by Draftsperson on form PTO-948.

All changes to the drawings, other than informalities noted by the Draftsperson, **MUST** be made in the same manner as above except that, normally, a highlighted (preferably red ink) sketch of the changes to be incorporated into the new drawings **MUST** be approved by the examiner before the application will be allowed. No changes will be permitted to be made, other than correction of informalities, unless the examiner has approved the proposed changes.

Timing of Corrections

Applicant is required to submit the drawing corrections within the time period set in the attached Office communication. See 37 CFR 1.85(a).

Failure to take corrective action within the set period will result in **ABANDONMENT** of the application.

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